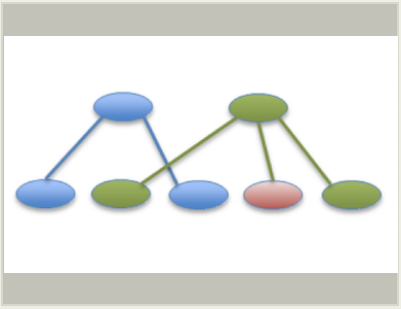
Multiple Failure Response Procedure System, Phase II

Completed Technology Project (2017 - 2019)

Project Introduction

Currently, flight controllers are often tasked with generating responses to multiple failures when they occur. However, during future space missions, flight controllers may be less available for this task, due to long communication delays during deep space missions, task overload as flight controllers manage many missions simultaneously, or reduced flight controller staffing per mission. To reduce the workload on the crew and/or flight controllers, it would be highly desirable to generate response procedures for multiple failures automatically or semi-automatically. When multiple failures occur, it seems attractive to use the procedures that were developed in advance to handle each of the individual failures. However, simply combining procedures in just any order might not work due to interactions among the faults, procedure goals, conditions, and effects. During Phase I, we began to develop the Multiple Failure Response Procedure (MFRP) System, which will automatically generate and present procedures for responding to multiple failures and ambiguity groups. The central idea of MFRP is to encode each the rationale of each procedure in a machine-readable way and to use this knowledge at run-time system to handle multiple problems and situations which may not have been specifically anticipated during procedure development. During Phase I, we developed a domain model and software prototype which generated valid responses for eight multiple failure scenarios for which naive application of single failure procedures was invalid or suboptimal, thus demonstrating the feasibility of our approach to multi-failure plan generation. For Phase II, we propose to extend MFRP flexibility, robustness, and ease of use. We will develop or enhance processes, models, algorithms, and software applications and tools to demonstrate the ability to handle complex domains, display multi-failure responses to users effectively, and reduce the cost and difficulty of applying MFRP to each domain.



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Small Business Innovation Research/Small Business Tech Transfer

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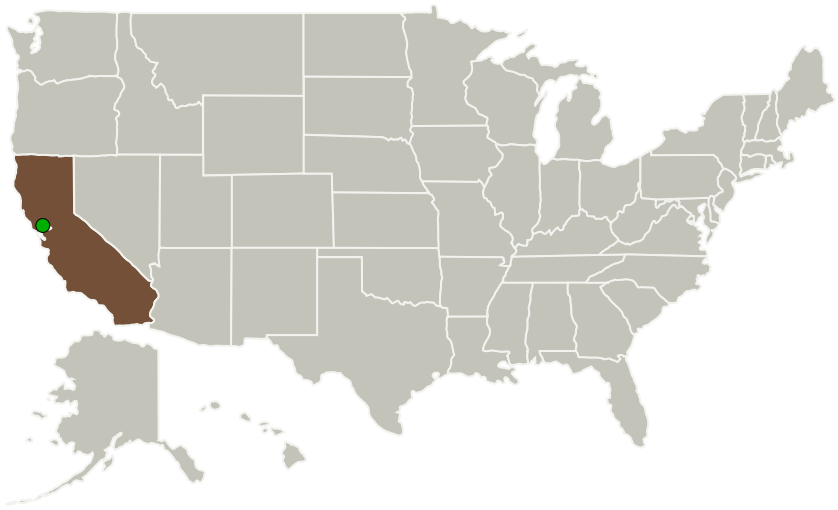
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Stottler Henke Associates, Inc.	Lead Organization	Industry	San Mateo, California
Ames Research Center(ARC)	Supporting Organization	NASA Center	Moffett Field, California

Primary U.S. Work Locations
California

Project Transitions

April 2017: Project Start

April 2019: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140982)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Stottler Henke Associates, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

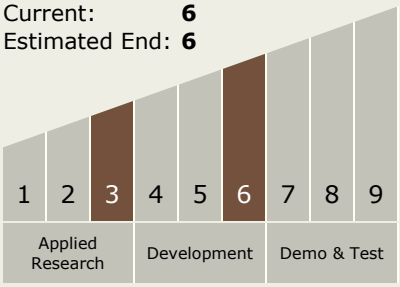
Carlos Torrez

Principal Investigator:

James C Ong

Technology Maturity (TRL)

Start: **3**
Current: **6**
Estimated End: **6**



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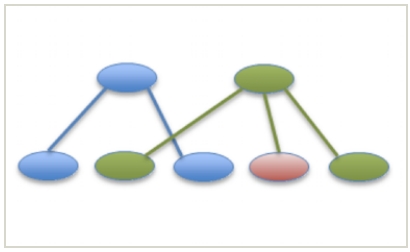
Images

Briefing Chart Image
Multiple Failure Response Procedure System, Phase II Briefing Chart Image
(https://techport.nasa.gov/image/132907)



Final Summary Chart Image
Multiple Failure Response Procedure System, Phase II
(https://techport.nasa.gov/image/134794)

Technology Areas

Primary:

- TX10 Autonomous Systems
  - TX10.2 Reasoning and Acting
    - TX10.2.6 Fault Response

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System